SPURT MINIMIZING DISPENSING STRUCTURE

CROSS REFERENCE TO RELATED APPLICATION(S)

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

REFERENCE TO A MICROFICHE APPENDIX

Not applicable.

TECHNICAL FIELD

This invention relates to a system for dispensing a product from a container. The invention is especially suitable for a dispensing structure for dispensing high viscosity fluids from a dispensing orifice normally closed by a lid.

BACKGROUND OF THE INVENTION AND TECHNICAL PROBLEMS POSED BY THE PRIOR ART

A variety of packages that include dispensing systems on containers have been developed for household products such as shampoos, lotions, food products and other substances. Such containers typically have a neck defining an open upper end on which is mounted a dispensing closure. The dispensing closure for these kinds of containers typically has a dispensing spout which is covered with a removable lid.

The closure typically has a closure deck or top wall and a depending skirt with an inside bead or thread for attachment to a container. The closure deck includes a dispensing orifice through which a fluid can be dispensed. Depending on the surface tension of the fluid being dispensed through the closure orifice and the coefficient of friction between the fluid and the closure, the fluid tends to cling to the underside of the closure deck and form a layer beneath the dispensing orifice after a dispensing operation. The resulting layer of fluid has a thickness generally dependent on the fluid viscosity.

The lid is typically reclosed to cover the orifice. When the lid is subsequently removed quickly from the closure deck prior to a dispensing operation, the outward movement of the lid has a tendency to immediately cause the fluid in the layer to "spurt", "burp" or otherwise be propelled out of the orifice prior to a controlled, intentional dispensing. The burping of the fluid can cause spatter on the user's hand or clothing or dripping on an exterior surface of the container.

It would be desirable to provide an improved dispensing structure wherein a dispensing orifice in a deck is normally closed by a closure lid which is openable away from a closure deck and wherein the dispensing structure is resistant to propelling fluid upon separation of the lid from the deck.

In addition, it is desirable that the improved dispensing structure design function well with a wide range of fluids, including high viscosity liquids and low viscosity liquids. It would also be beneficial if such an improved dispensing structure design could function well with fluids having different surface tension characteristics.

The present invention provides an improved dispensing structure which can accommodate designs having the above-discussed benefits and features.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, a dispensing structure is provided for a squeezable, fluid holding container so as to eliminate or minimize the propelling or spurting of fluid from a discharge orifice of the dispensing structure during removal or disengagement of a lid which normally closes the discharge orifice. The structure includes a body for closing an opening of the container. The body includes a closure deck having a discharge orifice ordinarily closed by a removable lid. Within the body, and extending from the closure deck, is (1) a conduit,such as a tube, surrounding the orifice and forming a flow channel or passage into the orifice, and (2) a surrounding wall structure, such as an outer ring, around the conduit.

In one embodiment, the surrounding wall structure extends deeper into the container than does the conduit, i.e., the conduit extends to a free end which is recessed upwardly from a free end of the surrounding wall structure.

The surrounding wall structure controls the formation of a "meniscus" of a layer of fluid formed within the discharge structure. The "meniscus" is understood to be a convex or concave surface of a column or layer of liquid. The conduit is sized to extend just beyond the meniscus in order to pierce through the layer of fluid, creating an air path from the interior of the container to the exterior of the container. The conduit acts to break the fluid layer that might otherwise form behind the orifice, thus relieving any pressure behind the layer that would tend to cause the product to "burp" or spurt when the lid is quickly opened. The passage within the conduit is sized such that the surface tension of the fluid resists flow into the conduit. Thus, flow into the conduit will only occur when positive pressure is applied to the contents of the container. Reduced interior pressure (i.e., partial vacuum) created by the container panels returning to their normal position after being squeezed, clears the conduit of fluid.

The diameter and height of the surrounding wall structure and the conduit can vary depending on the fluid and the environment. For example, larger diameters and less height differential are anticipated to be advantageous for more viscous fluids than less viscous, thinner fluids due to the shape and size of the formed meniscus.

The surrounding wall structure can be provided in the form of a ring member extending downwardly from the closure deck or can be formed as a part of the surrounding containment wall of the dispensing structure or container.

In another embodiment, the conduit extends into the dispensing structure as far inwardly as the inner end of the surrounding wall.

In both embodiments, the surrounding wall structure serves to encourage a meniscus to form around the conduit so as to minimize or prevent fluid accumulation in the conduit. The surrounding wall structure allows residual fluid to drip down the surrounding wall structure away from the conduit so as to minimize the tendency of the fluid to enter the conduit.

According to the invention, the dispensing structure can include a lid which may be hinged to, tethered to, or completely removable from, the body of the structure.

The dispensing structure of the present invention may be formed as a unitary part of the container. Alternatively, the dispensing structure may be formed as a separate piece which can be subsequently mounted to the container. Such a dispensing structure in the form of a closure can be designed for attachment to the top of the container by means of a threaded engagement or snap-on engagement.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention, from the claims, and from the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings forming part of the specification, in which like numerals are employed to designate like parts throughout the same,

FIG. **1** is a front perspective view of a first embodiment of the dispensing structure of the present invention shown with the lid open;

FIG. **2** is a cross-sectional view taken generally along plane **2**—**2** of FIG. **1**;

FIG. **3** is a fragmentary, cross-sectional view similar to FIG. **2**, but FIG. **3** shows an amount of fluid within the dispensing structure;

FIG. **3A** is a fragmentary, cross-sectional view of an alternate embodiment dispensing structure;

FIG. **4** is a fragmentary, cross-sectional view of an alternate embodiment of the dispensing structure, and FIG. **4** shows the dispensing structure mounted on a container.

DESCRIPTION OF THE PREFERRED EMBODIMENT

While this invention is susceptible of embodiment in many different forms, this specification and the accompanying drawings disclose two specific forms as examples of the invention. The invention is not intended to be limited to the embodiments so described, and the scope of the invention will be pointed out in the appended claims.

For ease of description, the dispensing structure of this invention is described in a typical upright position, and terms such as upper, lower, horizontal, etc., are used with reference to this position. It will be understood, however, that the structure may be manufactured and stored in orientations other than the one described.

A first embodiment of a dispensing structure of the present invention is illustrated in FIGS. **1**–**3** and is designated generally therein by the reference numeral **40**. The dispensing structure **40** is provided in the form of a closure **40** which is adapted to be mounted on a container (not illustrated in FIGS. **1**–**3**). The container typically has a conventional mouth or opening formed by a neck or other suitable structure. The neck typically has (but need not have) a circular cross-sectional configuration, and the body of the container may have another cross-sectional configuration, such as an oval cross-sectional shape, for example.

The container may be a squeezable container having a flexible wall or walls which can be grasped by the user and compressed to increase the internal pressure within the container so as to squeeze the product out of the container through the closure when opened. The container wall typically has sufficient, inherent resiliency so that when the squeezing forces are removed, the container wall returns to its normal, unstressed shape. Such a structure may be preferred in some applications, but may not be necessary or preferred in other applications. For example, the container may be rigid or substantially rigid and other means used to cause a dispensing force on the fluid within the container.

With reference to FIG. **1**, the closure **40** includes a base or body **46** and preferably includes a lid **48** connected to the base or body **46** with a hinge **47**. The lid **48** is adapted to be moved between (1) a closed position (not illustrated) in which the lid **48** is sealingly engaged with the closure body **46** to prevent unintentional dispensing of a fluid from the container to which the closure is mounted, and (2) the illustrated open position in which the lid **48** is disengaged from the top of the closure body to permit dispensing of the liquid through the closure.

Preferably, the hinge **47** is a snap-action hinge formed integrally with the lid **48** and body **46** in a unitary structure. The illustrated snap-action hinge **47** may be a conventional type described in U.S. Pat. No. 4,403,712. Other hinge structures may be employed, including a "floppy" living film hinge. However, it is preferable to employ a snap-action hinge so as to be able to readily maintain the hinge **47** and lid **48** in the open position during the dispensing of the liquid from the container.

The base or body **46** is preferably injectionmolded, along with the hinge **47** and lid **48**, from a thermoplastic material compatible with the container contents.

The body **46** includes an annular mounting skirt or lower wall **56**. The skirt or wall **56** defines an opening **57** (FIG. **2**) which is adapted to receive the container neck and which is adapted to completely encompass the container neck opening.

The wall **56** may have suitable attachment means (e.g., a conventional thread **55** (FIG. **2**) or conventional snap-fit bead (not illustrated)) for engaging a suitable container cooperating means, such as a complementary thread or bead on the container neck, to secure the closure body **46** to the container. The closure body **46** and container could also be fixed together by induction melting, ultrasonic melting, gluing, or the like. The closure could also be formed as a unitary part of the container neck.

Formed at the top of the annular mounting skirt **56** is a top wall portion or deck **58**. The deck **58** extends radially inwardly over the opening **57** defined by the annular mounting skirt **56**. The deck **58** defines a smaller, dispensing orifice **60** located above the opening **57** defined by the mounting skirt **56**.

The container and closure **40** may be normally stored in the upright orientation wherein the closure **40** is at the top of the container. The orifice **60** would be above the opening defined by the container neck when the closure **40** is mounted on the container. The closure lid **48** would typically be closed over the body deck **58** when liquid is not being dispensed from the container.

The deck **58** includes a raised platform **70**. The lid **48** includes an annular ring **72** having a beveled surface **72***a* which is adapted to be guided by an edge **70***a* of the platform **70** when the lid **48** is closed over the body **46**. The beveled surface **72***a* acts to center the lid **48** onto the platform **70** of the body **46**.

The deck **58** also includes a spout **80**. The spout **80** extends in a smooth, curved transition from the platform **70**. The platform **70** extends outwardly of, and extends continuously around, the spout **80**. The orifice **60** extends through an outer end of the spout **80**. In order to use the closure **40**, the lid **48** is opened to the position illustrated in FIG. **1**. Then the container, with the closure **40** mounted thereon, is tilted forwardly and downwardly. Fluid can then be squeezed out of the container through the spout **80** and dispensing orifice **60**.

Within the lid **48**, and particularly concentrically located within the annular ring **72**, is a collar **84** having a beveled lip **85** and an annular seal bead **86**. The collar **84** is located such that when the lid **48** is closed to engage the body **46**, the bead **86** sealingly engages the exterior surface of the spout **80**.

The lid **48** includes an outer annular wall **90** having a rim **91** which abuts top shoulders **92***a*, **92***b* (shown in FIG. **1**) of

the skirt **56** when the lid **48** is pushed onto the body **46**. The lid **48** also includes a rib **93** on a side thereof opposite the hinge **47**. The rib **93** establishes a snap-fit engagement with a lip **94** provided on the body skirt **56** when the lid **48** closed over the body **46**. As an alternate to the rib and lip arrangement, other interengaging or interlocking formations can be provided on the lid **48** and the body **46** to achieve a mutually engaged configuration. Alternatively, no positive engagement or interlocking of the lid wall **90** to the body **46** need be provided.

The skirt **56** includes a ribbed surface **56***a* which facilitates a person gripping the body **46** and unscrewing the body from a container (not shown). A crescent shaped recess **96** is included at the front of the body **46** opposite the hinge **47** to accommodate a person's finger or thumb below the lip **94** and rib **93** as the closed lid **48** is pried from the body **46**.

As shown in FIG. **2**, the spout **80** has an inside surface **100**. Extending downwardly from the inside surface **100** is a conduit, such as a tube **104**. In the preferred embodiment, the tube **104** has an annular cross-section, although other geometries, such as oval or polygonal cross-sections or other surrounding cross-sections, are encompassed by the invention. The tube **104** terminates at a free end **106** defining an inlet orifice **108**. The tube **104** merges into the spout **80** and defines a flow passage **109** extending between the dispensing orifice **60** and the inlet orifice **108**.

A surrounding wall structure, such as an outer ring **110**, surrounds the tube **104** and depends from an inside surface **114** of the deck **58**, particularly from the platform **70**. The surrounding wall structure **110** in the preferred embodiment has an annular cross-section, but also can have other geometries such as oval or polygonal cross-sections or other surrounding cross-sections.

The surrounding wall structure **110** terminates in a free end **118**. The free end **118** of surrounding wall structure **110** extends inwardly toward the container to a greater extent than does the free end **106** of the inner tube **104**. Although the surrounding wall structure **110** is illustrated as an inwardly projecting ring, the invention also contemplates that the surrounding wall structure **110** could be incorporated as a thicker part of the surrounding skirt **56** of the body **46** or of the container (not shown).

An annular lip seal **124** projects from the lower surface of the deck **58** and is resiliently deflected against the upper edge of the container neck, adjacent the container neck opening, so as to provide a leak-tight seal between the closure body **46** and the container neck. The seal **124** surrounds the outer ring **110**. Of course, other types of closure body/container seals may be employed.

The tube **104** in cooperation with the outer ring **110** prevents the spout **80** from burping, spurting, oozing, or otherwise propelling fluid through the orifice **60** when the lid **48**, particularly the inner seal bead **86**, is pulled away from the spout **80**. How this works to prevent such spurting can be explained with reference to FIG. **3**. FIG. **3** illustrates the condition of the body **46** after a quantity of fluid has been dispensed. Some fluid **126** is retained on the inside surfaces **100** and **114** of the deck **58** between the tube **104** and the outer ring **110**, and between the outer ring **110** and an annular, interior side surface **130** of the deck **58**. By locating and sizing the tube **104** and outer ring **110** according to the characteristics of the particular fluid and the environment (such as the ambient atmospheric pressure), the liquid **126** forms an annular meniscus **134** between the outer ring **110** and the tube **104**. The meniscus **134** is defined between an outer surrounding edge **134***a* (on the ring **110**) and an inner surrounding edge **134***b* (on the outer tube **104**).

The tube **104** extends at least just slightly beyond the meniscus **134** in order to project through the layer of fluid **126** which clings to the inside surface **100**. The inlet orifice **108** is thus open to the interior of the container (not shown), and the passage **109** through the spout **80** is maintained clear of fluid **126**.

With reference to FIG. **3**, an inside diameter D of the tube **104** is advantageously sized for the particular surface tension of the fluid **126** such that the fluid **126** resists flow into the tube **104**. Flow through the tube **104** will only occur when positive pressure is applied, (i.e., when the container is squeezed, or the liquid within the container is urged through the tube **104** by other means). If the container is a squeeze type of container, then a negative pressure or vacuum is temporarily created by the container when the walls of the container return to their normal position after being squeezed. This acts to clear the tube **104** of most, if not all, of the fluid that may have remained in the passage **109**.

Diameters and heights of the outer ring **110** and tube **104** will vary depending on the characteristics of the fluid and the environment. For example, larger diameters and less height differential are anticipated to be advantageous for more viscous liquids compared to less viscous liquids owing to the different meniscus effects of the liquids.

FIG. **4** illustrates an alternate, and presently preferred, embodiment of a dispensing structure in the form of a closure **140** that includes a lid **148** which is shown covering a closure body **146** which in turn is engaged with a container C. The body **146** includes a depending skirt **156**. The skirt **156** defines an open area **157** and has an interior thread **158** which co-acts with a thread **159** of the container C to secure the body **156** to the container C.

A dispensing orifice **160** is defined in an outer end of a nozzle **180** which extends radially inwardly from the skirt **156**. The nozzle **180** extends from a shoulder **192** defined at the upper periphery of the skirt portion **156**.

The lid **148** includes an internal sealing collar **184** for sealing against the nozzle **180**. The lid **148** has a bottom surface **193** which fits onto the shoulder **192** when the lid **148** is pushed onto the closure **146**.

The lid **148** also includes a centering ring **201** for centering the lid onto the nozzle **180** during installation. A sealing bead or other sealing arrangement (not shown) can be provided on the nozzle **180** or sealing collar **184**, if desired.

The nozzle **104** includes a conduit or tube **204** which extends inwardly toward the container C. The tube **204** has a free end **206** defining an inlet orifice **208**. The tube **204** defines a passage **209** extending from the inlet orifice **208** to the dispensing orifice **160**. A surrounding wall structure **210** extends from the nozzle **180** to a free end **218**. The free ends **206** and **218** are preferably located at an equal depth inside the body **146**.

The upper end of the tube **204** merges with the nozzle **180** at a frustoconical section **219** which defines a transition from an inner diameter D_1 to a larger diameter D_2 at the dispensing orifice **160**. The larger diameter D_2 increases the thickness of the stream of the fluid which is dispensed. This may be advantageous if it is desired to dispense, for example, a wide ribbon of mustard on a hot dog.

The section **219** and larger diameter orifice **160** provide a collection region **220** for any fluid which may flow up the tube **204** after the lid **148** is closed. This provides a larger volume for relieving pressure from behind and around such fluid. This can prevent or minimize such pressure from blowing fluid out of the collection region **220** through the orifice **160** when the lid **148** is subsequently opened.